

CHONDRODONTA, A NEW GENUS OF OSTREIFORM MOLLUSKS FROM THE CRETACEOUS, WITH DESCRIPTIONS OF THE GENOTYPE AND A NEW SPECIES.

By TIMOTHY W. STANTON, Ph. D.,

Paleontologist, U. S. Geological Survey.

A peculiar group of fossils that has hitherto been referred to the genus *Ostrea* has for some years been known to occur in the Cretaceous of southern Europe and of Texas. Attention was first prominently called to it by Choffat's description and figures of *Ostrea joannæ* from Portugal. The very similar form from Texas has been described by Hill as *O. munsoni*, and almost simultaneously by Cragin as a part of *Hippurites flabellifer*. Similar forms, to which reference will again be made, have been found in the Venetian Alps.

All these fossils have the general shape of *Ostrea*, but are very thin compressed forms, with the two valves similar and almost invariably still attached to each other, and with rather prominent dichotomous ribs. That this peculiar sculpture is not essential to the group, however, is proved by the occurrence of the smooth species described in this paper.

In connection with my general work on the invertebrates of the Comanche series, I have restudied *Ostrea munsoni*, examining the types of Hill and Cragin, together with a larger suite of specimens collected by myself near Austin and a few obtained by Messrs. Hill, Vaughan, Prather, and others at various points in Texas. By means of polished sections and by carefully cutting away the upper valve from a number of specimens, with the study of fragments and accidental fractures, it has been possible to determine satisfactorily most of the internal features of the shell and to prove that the species is not an *Ostrea* nor referable to any described genus. The new generic name *Chondrodonta* is therefore proposed with *Ostrea munsoni* Hill as the type. The new species described on a following page, though differing greatly in external appearance, has the same hinge structure, and

is referred to this genus. Authentic examples of *Ostrea joannæ* also show the characteristic hinge structure of *Chondrodonta* as seen in cross section. The collections referred to, except the types of Hill and Cragin, are in the United States National Museum, and this notice is published here by permission of the Director of the United States Geological Survey. The descriptions of the genus and of the two American species follow.

CHONDRODONTA, new genus.

Shell of rather large size, sessile, ostreiform, attached by the left (?) valve; texture, subnacreous; hinge plate greatly elongated, without proper teeth, but with a long chondrophore in each valve a little back of the median line, extending from the beak across the hinge plate and projecting considerably beyond it into the body cavity, the chondrophore of the attached valve forming the overhanging anterior wall of a deep, narrow groove into which is received the chondrophore of the upper valve in the form of a rather thin oblique lamella, whose free edge is slightly curved upward. Near their umbonal ends the chondrophores are nearly in contact, but toward their other extremities they are separated by a space of from 1 to 3 millimeters (according to the size of the shell). This space must have been filled by the resilium, which was evidently attached to the under side of the chondrophore in the lower valve and to the upper side of that in the free valve, the whole forming an interlocking arrangement that could have allowed very little motion of the valves, and is effective even after the resilium has disappeared, for the two valves are almost invariably found firmly united.

Pallial line remote from the margin, as in Pectinidae, Spondylidae, etc., usually not very distinctly marked; adductor muscle doubtless single, though its faint impression has not been positively recognized; lower valve, moderately convex; upper valve, flat or concave, so that the body cavity is very shallow; surface, either with radial, irregularly dichotomous plications, or nearly smooth, with only concentric growth lines.

Type.—*Ostrea munsoni* Hill, from the Edwards limestone of Texas; also represented by *Chondrodonta glabra*, new species, from probably the upper part of the Glen Rose limestone near Kerrville, Tex. European representatives of the genus are *Ostrea joannæ* from Portugal, probably *O. aff. munsoni* (Hill) Boehm, and possibly *Terquemia forojuliensis* Boehm from the southern Alps, all of which have been referred to the Cenomanian, though varying opinions have been held as to their exact position in the Cretaceous, the latest reference of *O. joannæ* being to the Turonian and of the Italian form to the Albian or Gault.

The peculiar interlocking chondrophores¹ will serve to distinguish this genus from any described type known to me, making it so distinct that it is difficult to assign it to any of the established families. The superficial resemblance of the shell to *Ostrea* is probably due almost entirely to its similar sedentary habit, and its internal features are too distinct to permit its reference to the same family.

The genus *Terquemia* Tate² (= *Carpenteria* Deslongschamps³ not Gray) is somewhat similar externally, but it is attached by the right valve, has a long, narrow, ligamental groove in each valve, and the rounded muscular scar is deeply impressed, while the pallial line is not visible. This name, *Terquemia*, was proposed for a few species of Liassic shells, was afterwards applied, probably erroneously, to several Triassic species, and still more recently to the above-mentioned Cretaceous form, which I suspect to be based on an imperfectly preserved specimen of *Chondrodonta*.

Some of the internal features of *Hippurites*, especially the pallial line and in thin-shelled specimens the faintly marked muscle scar, are suggestive of *Chondrodonta*. The chondrophore also extends across the hinge plate and projects slightly beyond it into the body cavity, but it is a deep, simple groove in each valve. In the early stages of growth the shell has well-marked ears, and in the right (attached) valve a byssal sinus, neither of which features has been recognized in *Chondrodonta*.

The affinities of *Chondrodonta* seem to be with the superfamily Pectinacea, which includes the Spondylidæ and Limidæ as well as the Pectinidæ. *Terquemia* has usually been referred to the Spondylidæ, but in Zittel's *Grundzüge der Palæontologie*, and also in the English edition of the same work, it is transferred to the Ostreidæ, without good reason, as it seems to me. Judging from figures and descriptions only, I would place it at least in the same superfamily with *Chondrodonta*.

CHONDRODONTA MUNSONI (Hill).

(Plate XXV, figs. 1-5.)

Ostrea munsoni HILL, Proc. Biol. Soc. of Washington, VII, 1893, p. 105, pl. XII.

Hippurites flabellifer CRAGIN (in part), 4th Ann. Rept. Geol. Surv. Texas, 1893, p. 190, pl. XL, fig. 1 (not pl. XXXVIII, fig. 3).

Shell attaining a large size, varying in outline from ovate to elongate-ovate, and irregularly triangular; beaks inconspicuous, slightly deflected laterally, with a variable, usually small, area of

¹This structure has been observed in eight specimens of *C. munsoni*, five of *C. glabra*, and four of *C. joanna*.

²Appendix to Woodward's *Manual of the Mollusca*, 1867, p. 65.

³Mém. Soc. Linn. de Normandie, XI, pp. 127-131, pl. XIX, figs. 2-11.

attachment on the lower valve; attached valve moderately convex, but varying considerably in this respect; upper valve¹ slightly concave, almost conforming to the curvature of the lower valve, so that the space between them is extremely thin; surface of both valves marked by rather fine radiating ribs, about equal in width to the interspaces, and many of them branching one or more times before reaching the margin, or with short ribs interpolated between them; sculpture often equally strong on both valves, but in some cases nearly obsolete on the upper valve; internal features as described for the genus.

Average specimens usually measure from 130 to 150 mm. in length and about 70 to 75 mm. in greatest breadth. One ovate specimen measures 121 mm. in length and 94 mm. in greatest breadth and occasional examples are more nearly circular in outline. One very large triangular specimen collected by Mr. Hill is 166 mm. in length and is expanded in fan-shape toward the base until it is 172 mm. broad. The convexity or thickness of the two valves united is seldom more than 10 mm. and there is little difference in this respect between young and adult shells.

There is a perceptible, though not great, variation in the coarseness of sculpture of different individuals, as may be seen by the illustrations.

The species is associated at most localities with *Radiolites davidsoni* Hill and it is often found attached to that form. This habit led Cragin and other members of the Geological Survey of Texas to suppose that both shells belonged to the same animal which was described as *Hippurites flabellifer*.² The shell is usually attached by one edge of the lower valve near the beak and it often shows a tendency to grow around the supporting object. A curious example of this is seen in the smaller of Hill's figured types (now preserved in the geological department of Johns Hopkins University), which shows a fragment of *Radiolites* shell nearly half an inch long firmly attached in a deep notch that involves both valves of the *Chondrodonta*.

Ostrea joanna Choffat³ from the Cretaceous of Portugal is very similar to this species in form, sculpture, and all other described characters except that the sculpture is considerably coarser. Through the courtesy of Prof. Paul Choffat I have received a dozen specimens of *O. joanna* from Monte Serres and Runa, Portugal, since this description was written. Sections were cut across the umbonal region of

¹ Mr. Hill inadvertently described the upper valve as the lower.

² This name has a few weeks' priority over *Ostrea munsoni*, but since it was applied to two entirely distinct forms its designation as *Hippurites* necessitates its restriction to the Rudistid portion of the complex species.

³ Recueil d'études paléontologiques sur la faune Cretacique du Portugal, I, p. 34, Ostreidae, pl. 1, figs. 1-7, and pl. 11, figs. 8-19. Lisbon, 1886.

several specimens, and in at least four these show essentially the same hinge structure as *O. munsoni*. I do not consider the Portuguese and Texan forms specifically identical, however, as Professor Choffat¹ has done, though they are certainly congeneric. The sculpture is much coarser in *O. joannæ* and the ribs are much more angular even when they are not larger. Choffat at first referred the horizon of *O. joannæ* to the Cenomanian, but in later papers he treats it as Turonian.

G. Boehm² has figured a form from the Venetian Alps as *Ostrea aff. munsoni* that still more closely resembles the Texan species in external features. Associated with it are some smaller shells that Boehm has described as *Terquemia forojuliensis*,³ figuring the interior of a worn specimen. This figure is such as might be drawn with a few slight errors in restoration from an imperfectly preserved attached valve of *Chondrodonta munsoni*, and it is very probable that the types of *Terquemia forojuliensis* are young specimens of the *Ostrea aff. munsoni*, and that they all belong to *Chondrodonta*. From the same region Futterer has described *Pinna ostreaformis*,⁴ which, according to Boehm, is identical with his *Ostrea aff. munsoni*, and more recently Schnarrenberger⁵ has identified probably the same form as *Ostrea munsoni*. These Italian fossils also have been referred to the upper Cenomanian by Boehm, though the beds containing them have at different times been referred to horizons as widely separated as the Urgonian and the Turonian. Schnarrenberger considers them older than the Cenomanian. In Choffat's latest paper, above cited, *O. munsoni* Hill, *O. aff. munsoni* Boehm, and *Pinna ostreaformis* Futterer, are all treated as synonyms of *O. joannæ*, and the Portuguese beds in which the species occurs are placed in the middle Turonian.

A note by Virgilio⁶ treating of the group of *Ostrea joannæ*, to which Professor Choffat kindly referred me, has not yet reached Washington, and so could not be consulted.

A few other forms, including one from the Nummulitic of Egypt, have been referred to the "group of *Ostrea joannæ*," but as nothing could be learned as to their internal features, they have not been considered. The sculpture alone is not to be depended upon as characteristic of this group. For example, Conrad⁷ figures a form under the

¹ Revue Critique de Paléozoologie, II, 1898, p. 174, and Mon. Strat. système crétacique du Portugal: La Crétacique supérieur au nord du Tage, pp. 183-184, Lisbon, 1900.

² Beiträge zur Kenntniss der Kreide in den Südalpen. I. Die Schiosi- und Calloneghe-Fauna, Palæontographica, XLI, 1894, p. 96, pl. viii, figs. 1, 2.

³ Idem., figs. 5 and 6.

⁴ Paleont. Abhandl., Dames und Kayser, VI (new series II), 1896, Pt. 2, p. 259.

⁵ Berichte d. Naturforschenden Gesellschaft zu Freiburg i. Br. XI, July, 1901, Pt. 3, p. 196.

⁶ Bolletino della Societa Geologica Italiana, XX, 1901.

⁷ Lynch's Report of the United States Expedition to Explore the Dead Sea and the River Jordan, pl. 1, figs. 7 and 8.

name *Ostrea virgata*, which has a lower valve, with sculpture quite similar to that of *C. munsoni*, but examination of the original specimen, now in the museum of Yale University, shows that it is a true *Ostrea* with a smooth upper valve and not at all related to *C. munsoni*.

Localities and position.—Hill's figured types came from Belton, Texas; those discussed by Cragin as part of a supposed *Hippurites*, from Bartons Creek, near Austin, Double Mountain, in Stonewall County, and Big Springs, Howard County; additional specimens in the Texas State collection are labeled "Cooper Mountain, Kent County;" the specimens now figured are from Noland's River at Belton, and from the bed of Bartons Creek, near the stone bridge 2 miles from Austin, where the species is abundant; a few additional specimens are from near Kickapoo Springs, on the west fork of Nueces River, from High Bridge, on Pecos River, and from Bluff Creek, about 25 miles west of Waco, the latter collected by Mr. John K. Prather. The species is confined to the Edwards or "Caprina" limestone, in the Fredericksburg division of the Comanche series. Precise correlation of the horizon with the European section will not now be attempted, but it is certainly much older than the Turonian.

CHONDRODONTA GLABRA, new species.

(Plate XXVI, figs. 1-3.)

Shell rather large, flat, or sometimes variously bent; lower valve gently convex; upper valve concave, closely conforming to the curvature of the attached valve; beaks inconspicuous, submedian, scarcely at all deflected laterally, with a very small area of attachment on the lower valve; surface of both valves smooth with only irregular lines of growth; internal characters as described for the genus, the hinge plate of the lower valve showing also one or two obscure shallow grooves in advance of the chondrophore.

An average specimen measures 117 mm. in length, 68 mm. in greatest breadth, and 10 mm. in convexity of the two valves united. The general habit of the shell is very similar to that of *C. munsoni* and the structure of the hinge is essentially the same. The smooth surface at once separates it from that species. It also appears to be somewhat more regular in form and more nacreous in texture.

Locality and position.—The types (five specimens) were collected by the writer in 1895 at a quarry one mile east of Kerrville, Texas, where the species is abundant, associated with *Monopleura* in a thin band near the middle of the limestone then quarried. The horizon was thought to be the upper part of the Glen Rose, and therefore considerably older than the horizon of *C. munsoni*, though I did not have the opportunity to study the stratigraphy of the neighborhood in detail.

EXPLANATION OF PLATES.

PLATE XXV.

Chondrodonta munsoni (Hill), p. 302.

- Fig. 1. Lower valve of a medium-sized somewhat elongate specimen lacking nearly an inch of the umbonal portion and cut across the lower part of the hinge.
2. View of the upper end of specimen represented by fig. 1, polished to show transverse section of the two valves and their chondrophores.
3. A similar section across the lower part of the hinge of the same specimen at the cut shown in fig. 1.
- 4, 5. Opposite views of a small specimen showing sculpture of the same strength on both valves.
(The specimen represented by figs. 1-3 has the upper valve nearly smooth.)

PLATE XXVI.

Chondrodonta glabra, new species, p. 305.

- Fig. 1. Exterior of a small attached valve. (The striations on the lower portion are accidental, due to slight slipping movements of the rocks.)
2. Interior of same, showing the hinge and the pallial line; *pp*, pallial impression; *cl*, chondrophore of lower valve; *cu*, broken edge of chondrophore of the upper valve still adhering in the groove of the lower valve. At its broken distal extremity it may be seen curving under the other chondrophore.
3. Cross section of lower part of the hinge of a larger specimen.